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VOLUNTARY RESPIRATORY EXERCISE IN THE TREATMENT OF PHTHISIS.

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Every one admits that the most successful treatment is that which is begun early. But there is even a greater difficulty than beginning treatment early; it is the continuance of it. Tuberculous patients should be instructed that their disease is preëminently a chronic one. If recovery takes place it is only after many months, and usually after many years of good care. There are some diseases, especially, perhaps syphilis, which the laity understand require time for treatment, and when the physician tells the sufferer in the beginning that he must be under treatment for many months he submits without hesitation; but this is not true in regard to tuberculosis. Many recoveries are not made when they might be, because of the frequent discontinuance of treatment. Patients are particularly apt to stop treatment in the periods of quiescence although it is at these times that most can be hoped for effecting genuine recovery. During periods of exacerbation of the disease medicinal treatment and the constant care of a physician is necessary, just as it would be necessary in any acute or subacute illness. We can accomplish the most toward bringing about recovery during periods of quiescence by correcting the habits of patients. It is not at this time that medication is required; often the less medicine given the better, but patients should be taught to live so as to correct deformities of the chest and insure healing of the lungs. In the stage of incipency and during the periods of quiescence, most can be accomplished by changes of climate, while during the exacerbations of inflammation in the lungs, comparatively little relief is obtained by such changes.

Unfortunately there are a large class of patients who cannot take advantage of changes of climate and it is with reference to one of the means of treating this class that I wish to speak. We have no substitute, for one of the most important benefits derived from a change of climate. It is the mental buoyancy

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which the faithful patients themselves have in the change produces. It has become a popular belief that consumption is more surely cured by change of climate than by anything else; therefore although when a change is made patients recognize the fact that it must be a prolonged one, they have a degree of buoyancy and hope from the expectation of recovery, that aids materially in again establishing good general nutrition. Change of residence should also remove patients from the frequent temperature changes, the cold and damp of our climate. In the chronic cases in which the lesions develop slowly, in which the lungs are often very much contracted, the best results are obtained by a change to a high altitude. In these cases beneficial results come largely from the mechanical effects produced within the lungs, by breathing rarified air.

At home we can obtain to some extent the same results by the use of mechanical appliances, such as the pneumatic cabinet. The latter can however be utilized by comparatively few. The same results can be obtained more gradually, but ultimately as perfectly by voluntary respiratory exercises persisted in for a very long period of time. By voluntary respiratory exercises I mean the drawing frequently but slowly the deepest possible inspiration. In order to obtain the good effects which such respiratory exercise can produce it must be repeated frequently, and the best results are obtained if it is taken in the open air. In my own practice I usually urge patients, for whom such exercise is applicable, to fill the chest to its utmost while out of doors once in so many minutes, or if they are walking, at the end of each half block. By filling the lungs as completely, but as slowly as possible, all the respiratory muscles are brought into action. In phthisical patients the strength of the respiratory movements is at first so little that the results of the exercise are almost inappreciable but by degrees they become marked. The first good effect produced by persistent respiratory exercise is strengthening the chest muscles. All have observed in consumptives a diminished ability to draw deep breaths. Commonly when their chests are measured the difference between complete expiration and complete inspiration is not over an inch and a half, or two inches at most; sometimes it is much less. The chest is usually sunken, the muscles thin, atrophied and weak. The difficulty of inflating the lungs is due in part to the muscular atrophy which hurried, shallow respirations have helped to produce, but to a greater extent to infiltration of the lung tissue not only with solid

cellular exudates, but with serous ones which make much of the lung tissue incapable of the degree of expansion and elastic contraction it should have. The elasticity of the lungs is temporarily diminished by these exudates, and may be permanently by genuine consolidation.

Besides strengthening the respiratory muscles breathing exercise also strengthens the muscles of the shoulders and back. This will often straighten the shoulders when stooped and the back when bowed. Deep and full respiration also helps very much to empty the bronchial tubes of the mucous which they contain. It does not do this to the extent that the pneumatic cabinet will, but the contents of the bronchial tubes will be dislodged more forcefully and emptied more perfectly than would happen if deep inspiration were not made. In the beginning of treatment deep respirations frequently provoke coughing, but this is not a contraindication for their practice. It frees the bronchial tubes and after the coughing spell is over it will not be soon repeated.

Gradually, the respiratory movements become more forcible and a larger quantity of air is habitually emptied from the lungs and drawn into them. This will aid in preventing the spread of infectious matter through the lungs. Many new lesions which form here and there in the lungs, are produced by the bacilli which are carried from one part of the lung to another by air expired from one bronchus and inspired into another. If respiration is shallow the tidal air will fill the large bronchi only. During expiration the air within the alveoli and smaller bronchi will be drawn only into those of medium size and with the next inspiration will be swept back into the lungs again, probably by another bronchiole, and may carry with it mucus laden with bacilli. If, however, the respiratory movements are habitually more forceful, secretions will more uniformly find their way into the large bronchi or trachea and they will remain too short a time in the lungs for bacilli to get permanently lodged in them.

Deep inspirations of this kind tend to correct deformities which the disease may have produced. They will cause a decided increase in the size of the chest and as a matter of course by increasing the size of the thorax may overcome contractions of it. This is accomplished by producing first a compensative emphysema here and there in the lungs. When alveoli about patches of consolidation become distended by emphysema and their walls are made thin and the vessels in them narrow or comparatively bloodless congestion or inflammation of them is almost

impossible. Therefore the spread of inflammation from the tuberculous foci will be limited.

Good effects are produced by such exercises in other ways. They help to cause a reabsorption of exudates, particularly of serous ones, but somewhat also of catarrhal ones. This is due to an improved lymph circulation. A better circulation of lymph is produced because when a deep inspiration is made and the breath held for a moment, the lung tissue is compressed against the thoracic wall. Whatever may then be in the lung tissue is to some extent squeezed from it. During expiration the lung tissue is not under pressure and fills with blood or with lymph which is again pressed out by a deep, full inspiration, just as by the hand we can squeeze water from a sponge. A better circulation in the veins and arteries is also promoted and therefore a better nutrition of the lungs maintained. Through inflamed tissues the blood moves slowly on account of a persistent engorgement of them, and even in the tissues immediately surrounding the inflamed ones there is engorgement and changes which border upon inflammation or which may be converted into it. If when there are such areas of chronic inflammation in the lungs, the blood vessels in the alveolar walls are placed under pressure by the air during deep inspiration, the blood will be pressed out of the capillaries and arteries and helped into the left side of the heart. The extra labor which the right heart has been doing in pumping the blood through the congested vessels will be much relieved, for the arteries generally will fill more perfectly and the veins empty more perfectly because of these exercises. It is true all these effects are obtained best in those who are in the stage of incipency or when the disease is in a quiescent state.

Just in proportion as the circulation through the lungs is maintained better will general nutrition be improved, for when more blood is carried to the lungs for oxydation and is better oxygenated it will when carried throughout the body maintain more perfect metabolic changes in all tissues.

These changes constitute the mode of action of voluntary respiratory exercise in phthisis.

A word in regard to the indications and contraindications for using this mode of treatment. It is more particularly indicated in the stage of incipency and when the disease is quiescent. Most can be accomplished, also in the earlier years of life, in early manhood and youth. It is an almost useless mode of treatment when patients are very greatly weakened either in the beginning of the dis-

ease or any stage in its progress. It is contraindicated too, when there is much pyrexia, particularly if the fever is high or constant. If attempted when there is fever these exercises persistently carried out will weary the patient and usually increase the temperature.

Such exercises are contraindicated when there are large cavities in the lungs, and immediately after hemorrhage from the lungs because forcible and deeper respiration may dislodge a clot and provoke additional hemorrhage. These exercises will accomplish little good unless tried in suitable cases and persisted in.

To illustrate the effects of such exercises, I will briefly describe the changes in two cases. By searching my records more carefully, more striking examples might have been found, but these will answer the purpose well. The first patient, a young man of twenty-seven, came to me last September. The whole of the upper lobe of the right side was decidedly dull. The respiratory sounds were low, feeble, nonvesicular and lacked force. At the left apex there was very little dullness, and the respiratory sounds were moderately exaggerated. The patient was five feet ten inches in height, his girth at the time of the first examination was thirty-one inches when a full inspiration was made, thirty-two and one-half inches, when a complete expiration was made, his weight was 118 pounds. He coughed frequently and severely. The cough produced sometimes vomiting. He had expectorated blood a few times in small quantities. There were occasional night sweats. The pulse was ninety, moderately full and temperature ninety-nine. In November the expansion was two and one-half inches, his cough was less frequent, expectoration less in amount, pulse eighty-four and strong, appetite good, no night sweats and temperature for the most part normal. In December expansion was the same. Toward the end of January he had gained several pounds in flesh. At this time he had some pain in the chest of a fleeting character, undoubtedly, however, pleuritic in nature. His breathing was habitually much deeper than it had been and the respiratory sounds stronger. They were no longer low and nonvesicular in the right apex but more forceful, almost exaggerated in character. In February he appeared very much the same. On the 18th of March he weighed 125 pounds, his pulse was seventy-eight, girth from thirty-one and one-half, when he had expired completely, to thirty-five when he filled his chest completely, an expansion of three and one-half inches instead of one and one-half as it was when he came to me in September. This patient was one of

few who persisted faithfully in the practice of respiratory exercises. The disease was in the stage of incipency when we can expect the best results from this mode of treatment. In proportion as the respiratory capacity increased, the pulse rate fell, temperature became persistently normal, cough and expectoration lessened. In a word all symptoms improved. In tuberculosis of the lungs the pulse is in rapidity out of proportion to the temperature; even if the latter is ninety-eight and one-half, or almost normal, the pulse is usually ninety or one hundred, soft and small. When the respiratory capacity is increased the circulation through the lungs is made better, the heart's beat grows stronger, and then the larger circulation and general nutrition are improved.

The second case is that of a bookbinder about 24 years of age. When first seen by me in February, 1892, there was consolidation of the apex of both lungs. Pleuritic pains were frequent. He had had several hemorrhages. He was sweating almost every night. His height was 5 feet 8 inches, his girth on complete expiration $29\frac{1}{2}$, on complete inspiration 31 inches, his temperature 101°F , his pulse 100. In March he was coughing less. The chest measurements were practically the same. In April the sweating had ceased or occurred very rarely, expectoration was considerably lessened, his strength increased, and there was a moderate increase in weight. Pulse 90, temperature normal, girth $29\frac{3}{4}$ inches when the chest was completely emptied, (the increase is due to increased flesh); on complete inspiration the girth was $31\frac{3}{4}$ inches. A slight gain in lung capacity. By May he had gained several pounds of flesh, coughing was much less frequent, and in every way he was feeling better. In July, on complete expiration his girth was $29\frac{3}{4}$ inches, and on full inspiration $32\frac{1}{2}$, pulse normal. In September his girth was $29\frac{3}{4}$ inches on complete expiration, $33\frac{1}{2}$ on complete inspiration, the difference being $3\frac{3}{4}$ inches. This patient was warned not to go back to his indoor sedentary work. During this period of improvement he had lived an active outdoor life, doing no work but taking the best care of himself. However, in the latter part of the summer, feeling so well, he began to work at his trade, bookbinding. He continued to do comparatively well until cold weather set in. The windows of the bindery were then closed and the room was often overheated. He began to cough more, pain returned in his chest, his respiratory capacity was slightly diminished, and his bodily temperature increased a little. In November I found his temperature $100\frac{1}{2}^{\circ}\text{F}$, his pulse 90; on complete expiration girth $29\frac{3}{4}$ inches, on inspiration $32\frac{1}{2}$, a slight diminution over that of four or five

months earlier when he was at his best. He has since been improving, but only on resuming his outdoor life.

I have called attention to this mode of treatment not because it is novel but because I believe it is not often enough prescribed or patients sufficiently instructed in regard to it. It is surprising that so few patients know how to perform the respiratory exercises. Many of them must be taught how to make a full inspiration, particularly is this true of phthisical patients. Occasionally I find one who has been interested in athletics and has learned how to breathe well. Such patients almost invariably begin on the respiratory exercises and carry them on faithfully, because they have already learned their good effects.

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